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Wu

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(54) **SECURING APPARATUS OF ADJUSTABLE WRENCH TO PREVENT MOVABLE JAW FROM TREMBLING**

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(51) **Int. Cl.**[7] **B25B 13/16**
(52) **U.S. Cl.** **81/157**; 81/133; 81/134; 81/138; 81/143
(58) **Field of Search** 81/133, 134, 138, 81/143, 157, 165, 170

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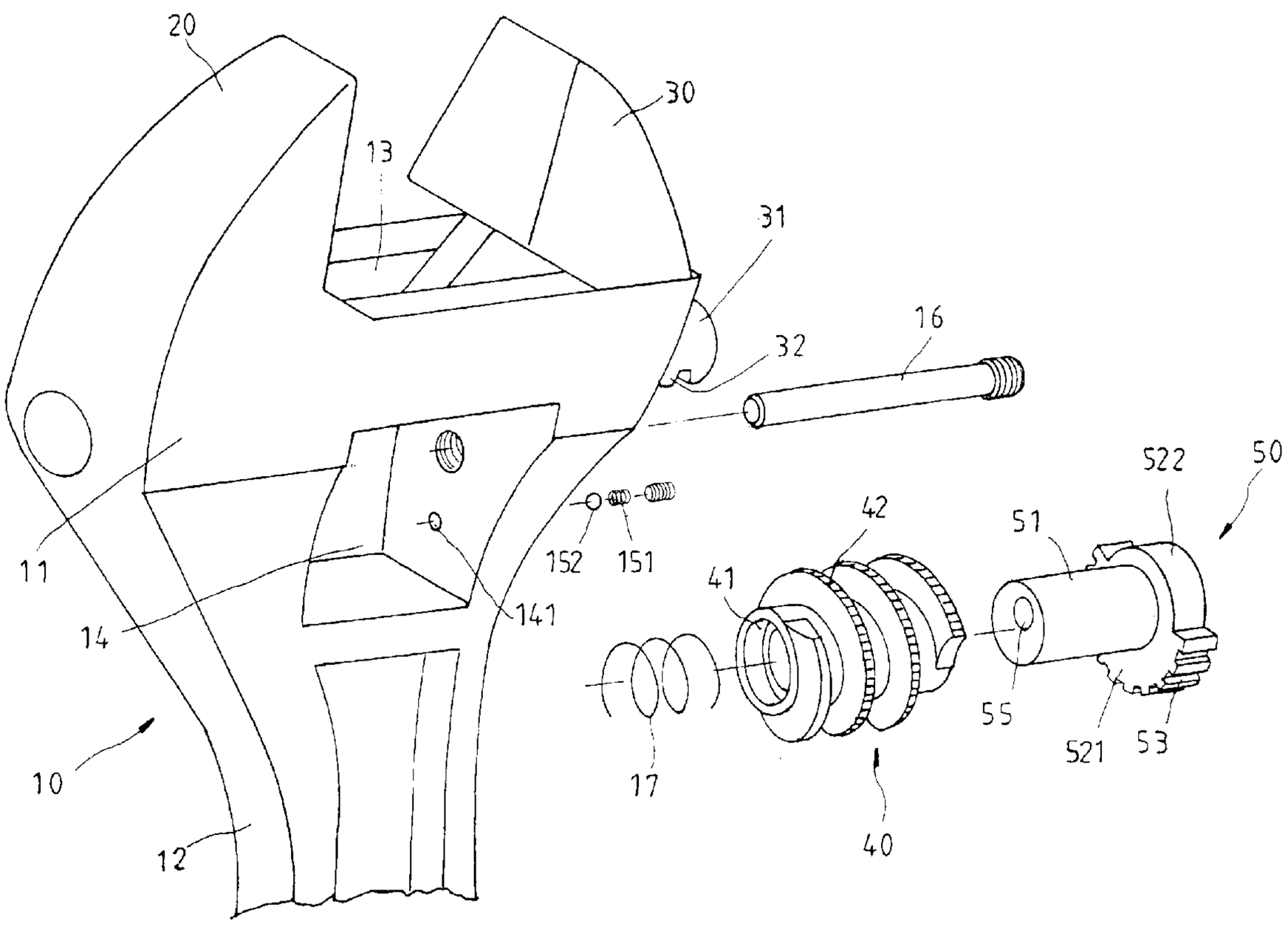
(57) **ABSTRACT**

An adjustable wrench has a handle having a fixed jaw, a movable jaw, an adjusting worm and an adjusting device. The adjusting worm is received in an opening of the handle and engages with the movable jaw to drive the movable jaw to move along the guiding slot. The adjusting device has an axle portion received in a through hole of the adjusting worm and a wheel portion positioned beside the adjusting worm. The adjusting device is pivoted on the handle via a shaft to be turned along a rotation axle and the adjusting worm is turned along a rotation axle. The rotation axles of the adjusting device and the adjusting worm deviate from each other whereby the adjusting device is turned to move the adjusting worm toward or away from the movable jaw.

9 Claims, 8 Drawing Sheets



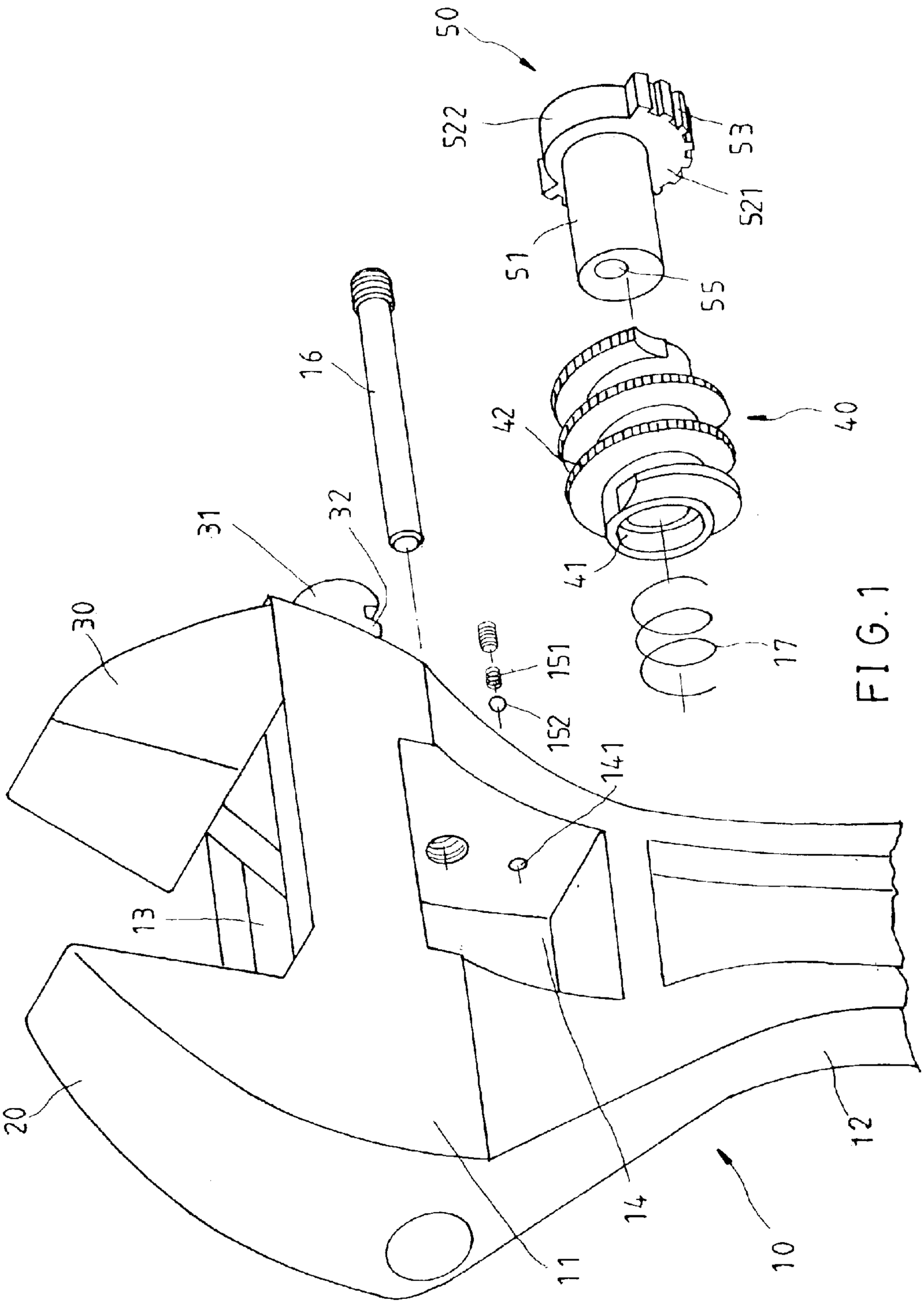

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FIG. 1

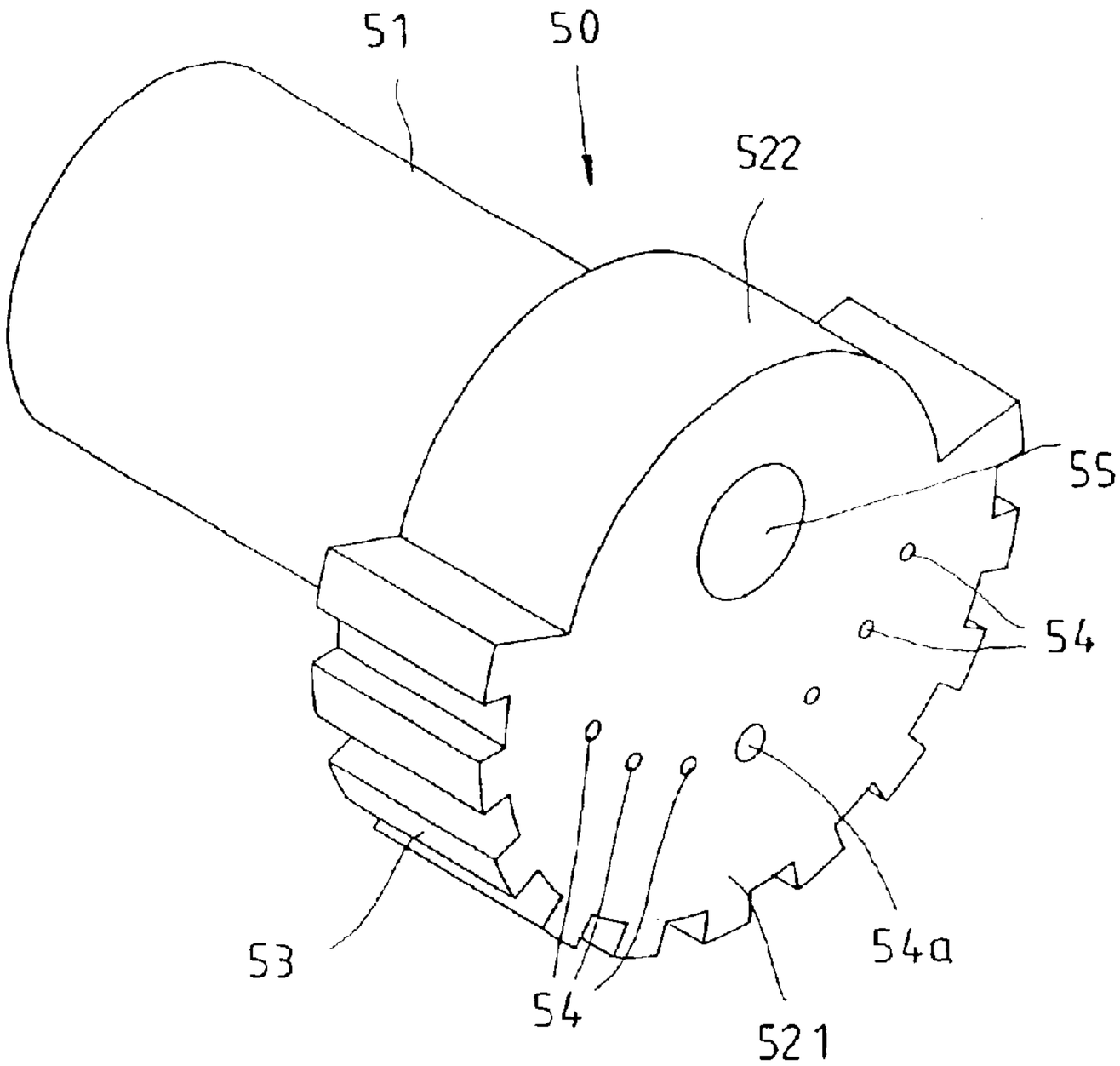

FIG. 2

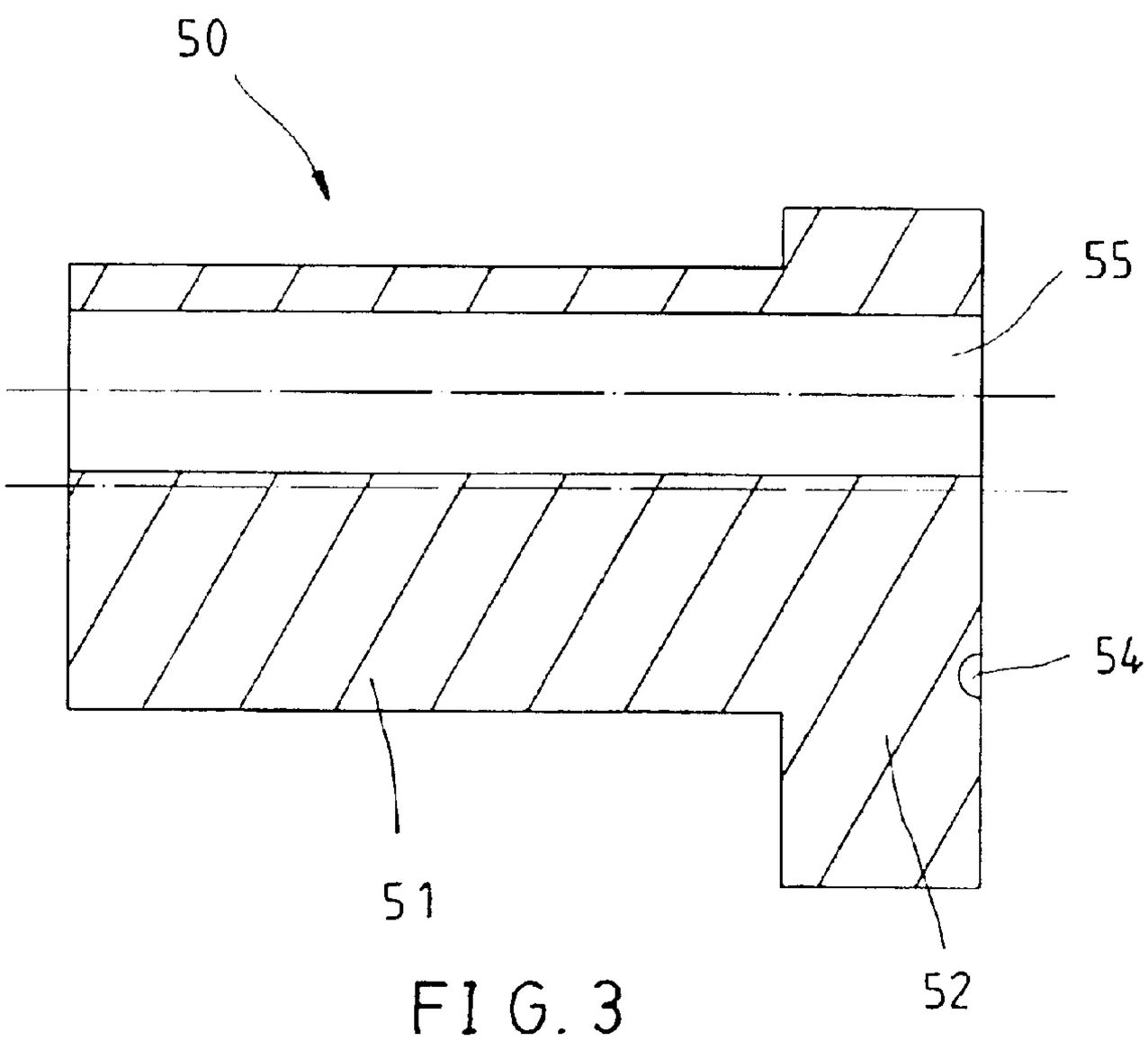

FIG. 3

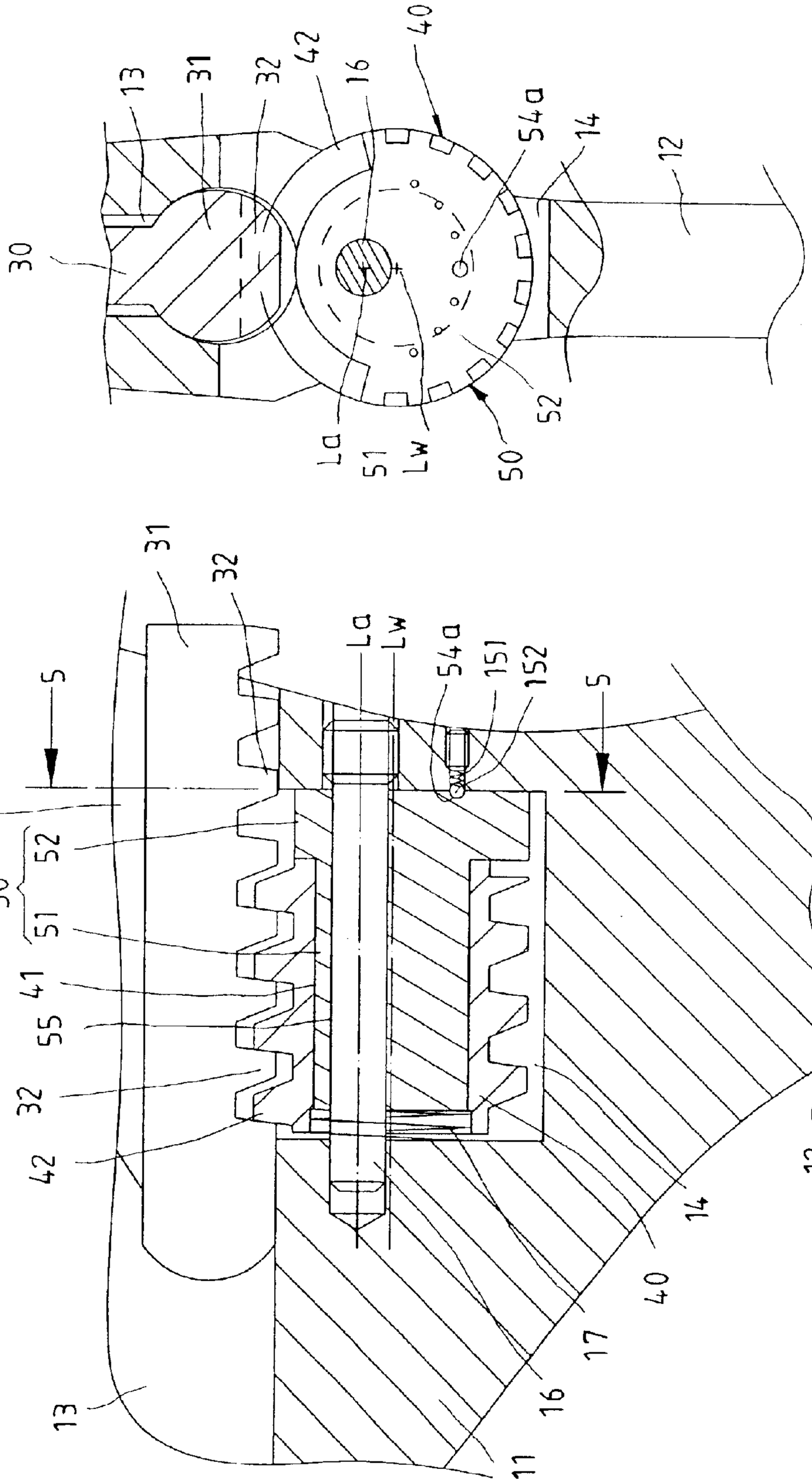

FIG. 4

FIG. 5

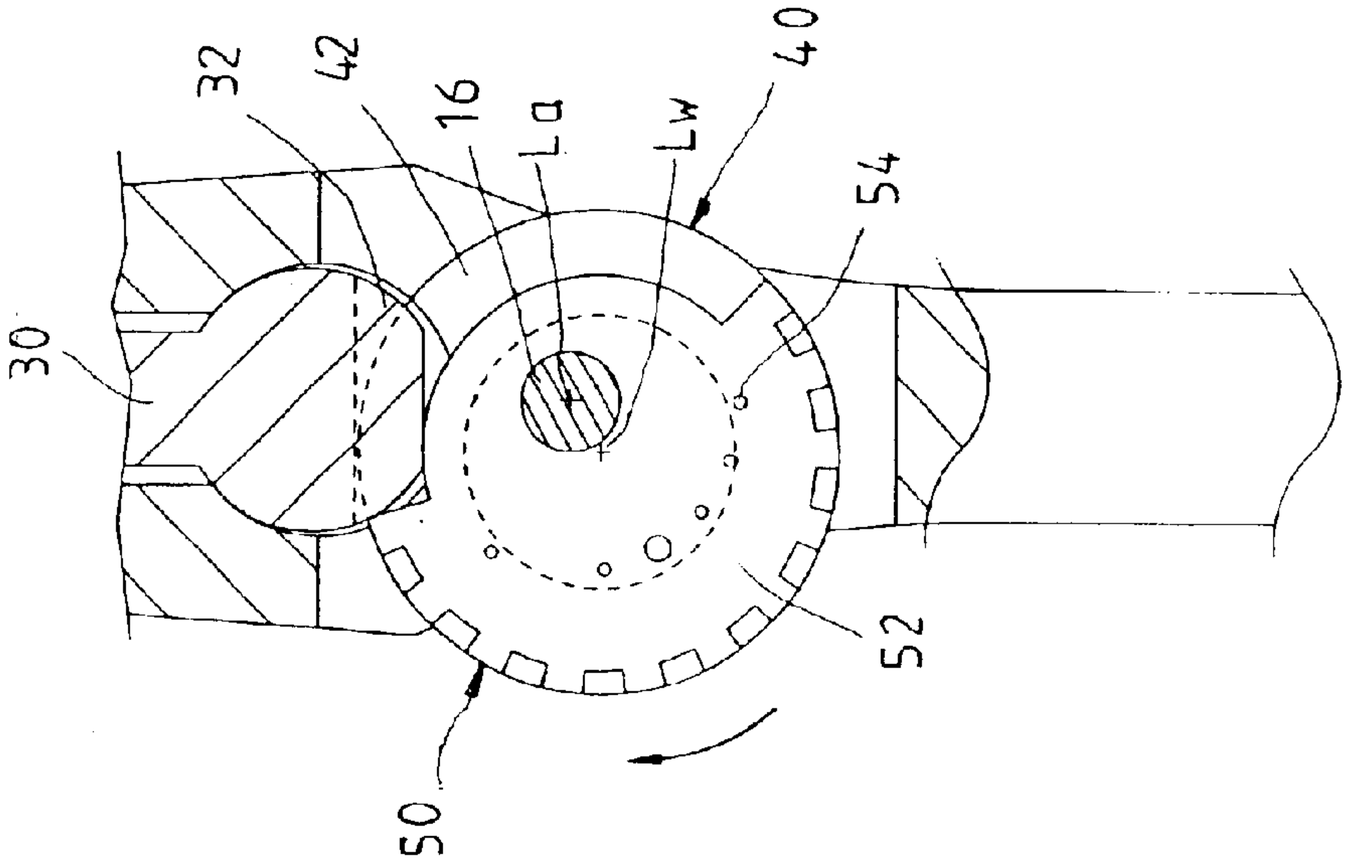

FIG.7

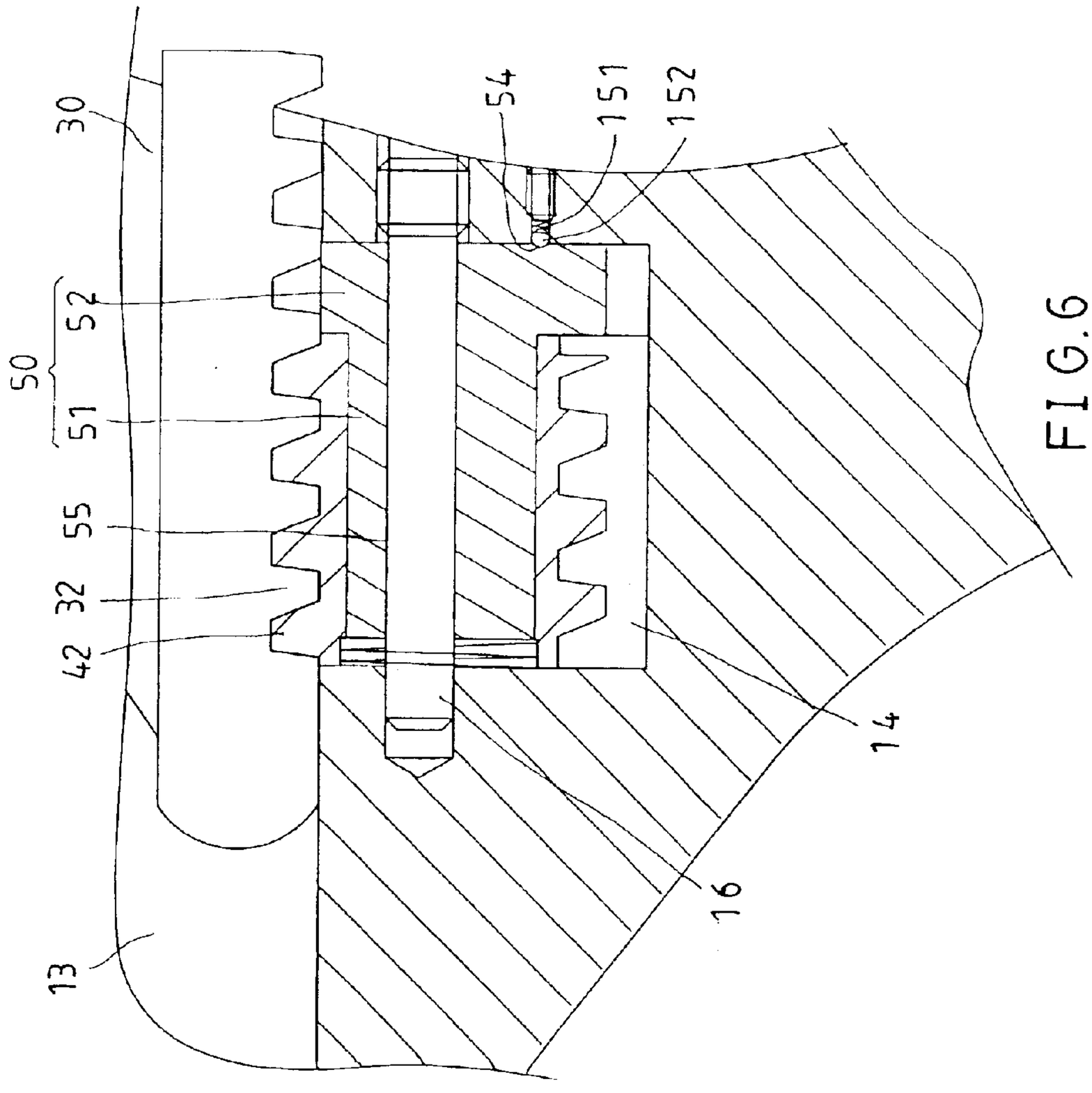

FIG.6

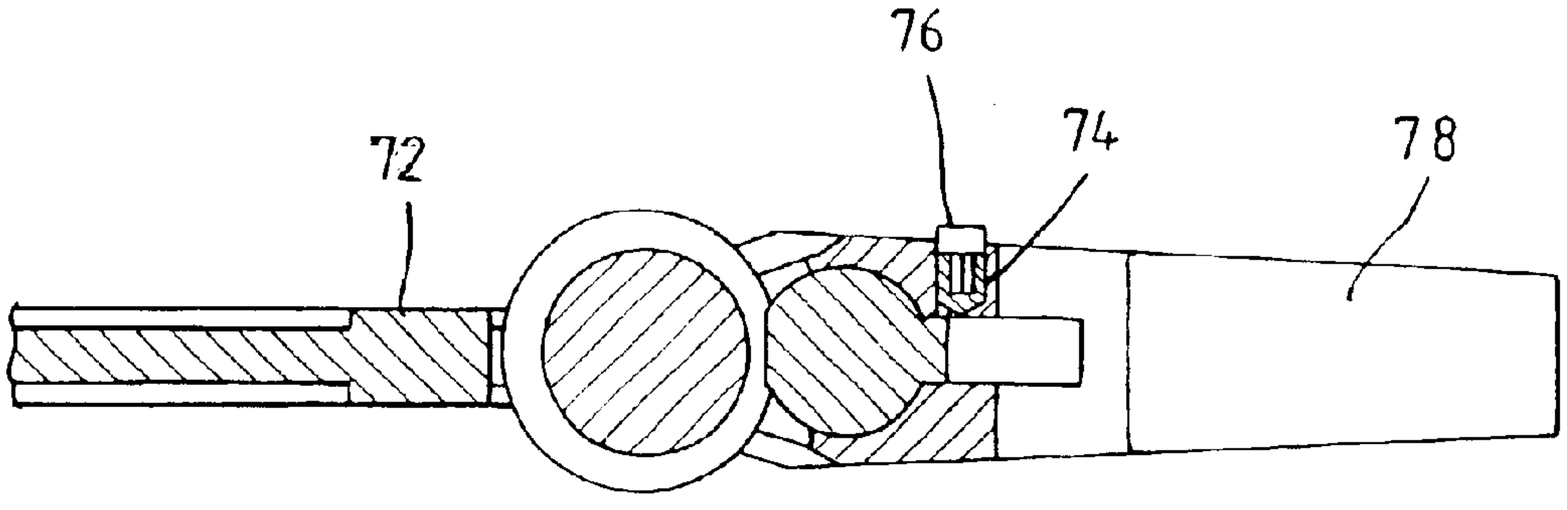

FIG.8
PRIOR ART

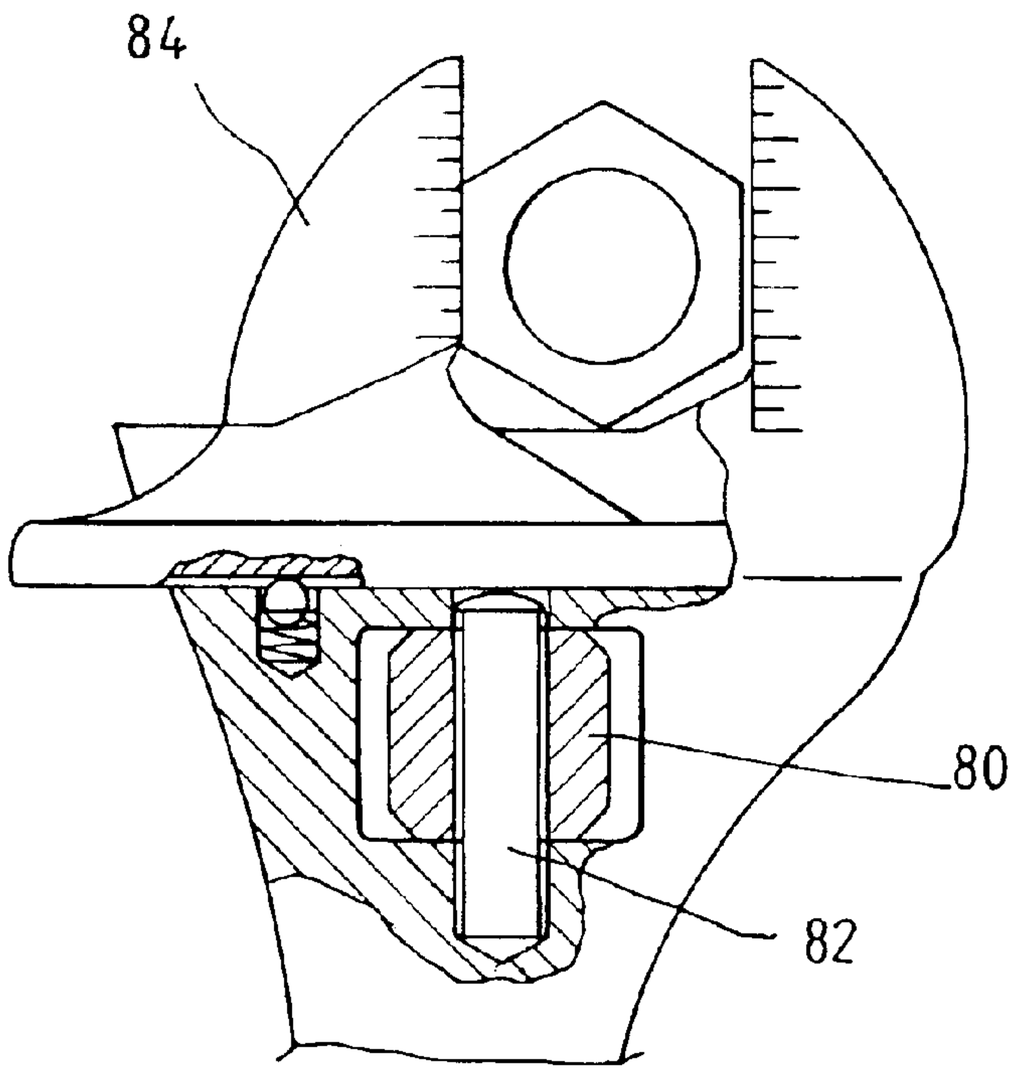

FIG.9
PRIOR ART

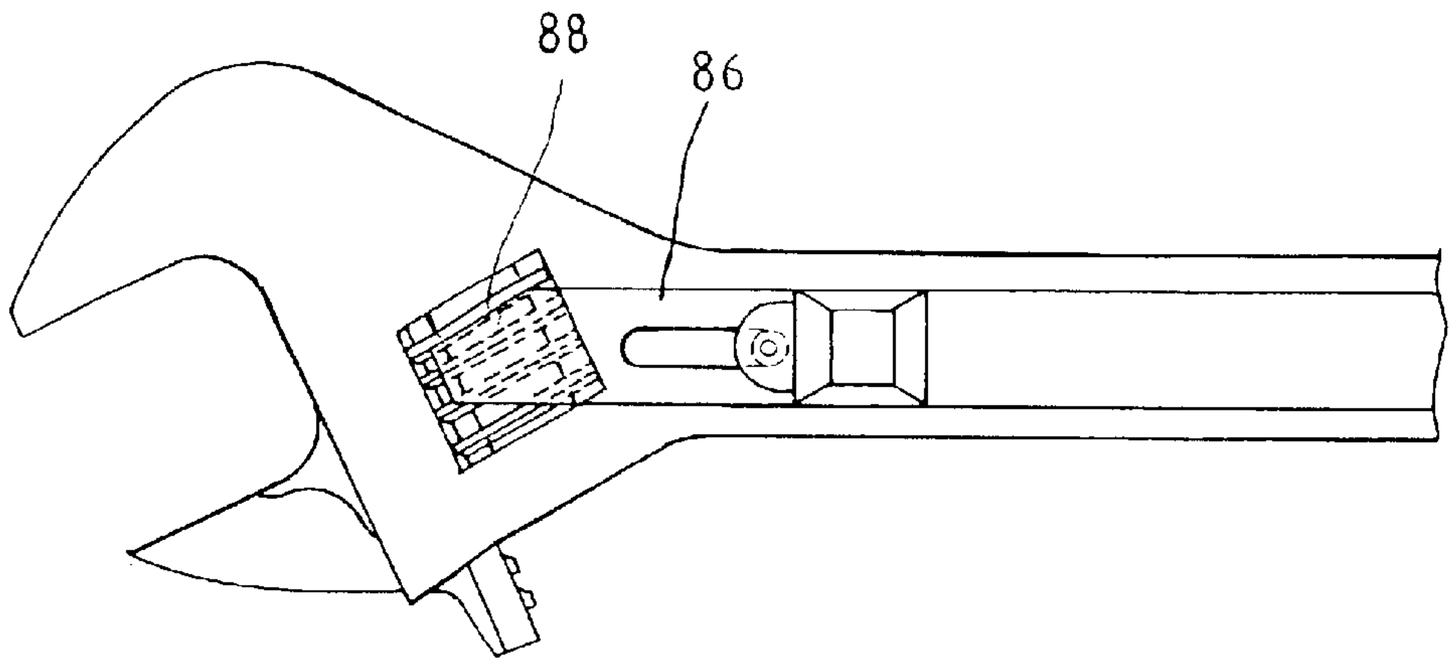

FIG.10
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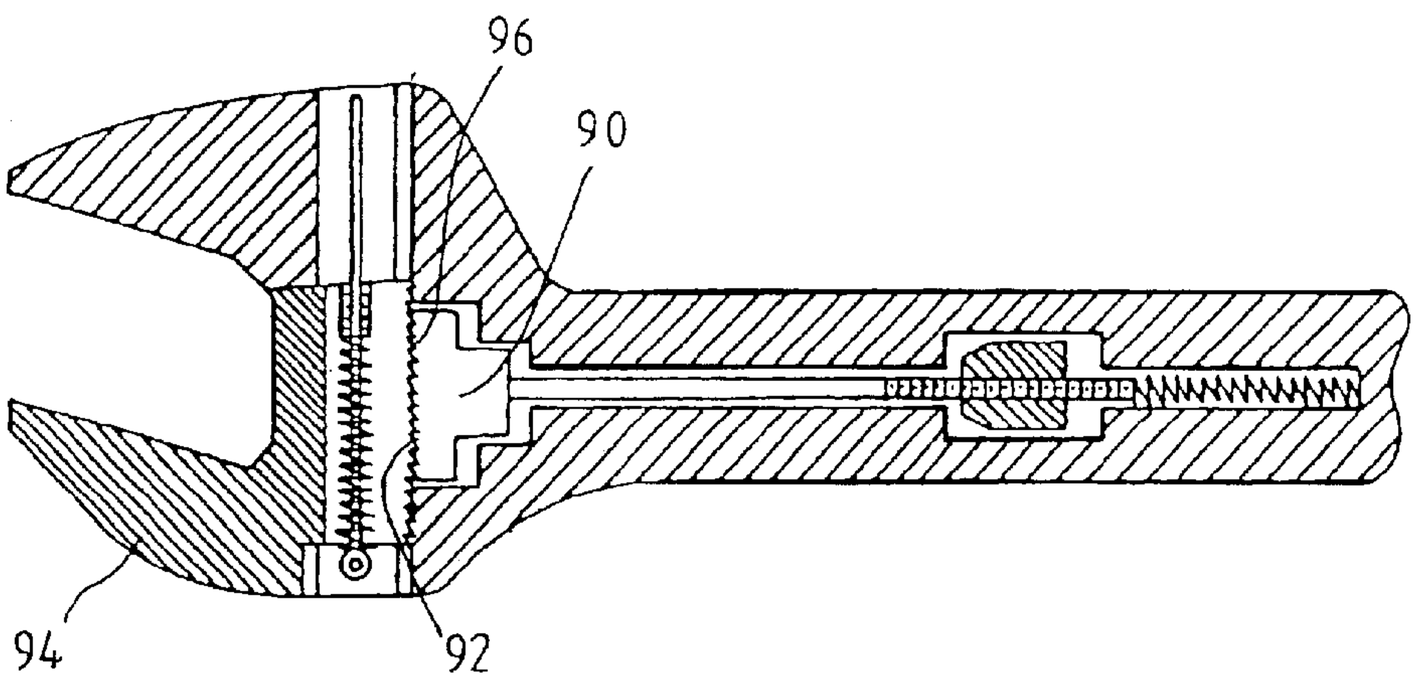

FIG.11
PRIOR ART

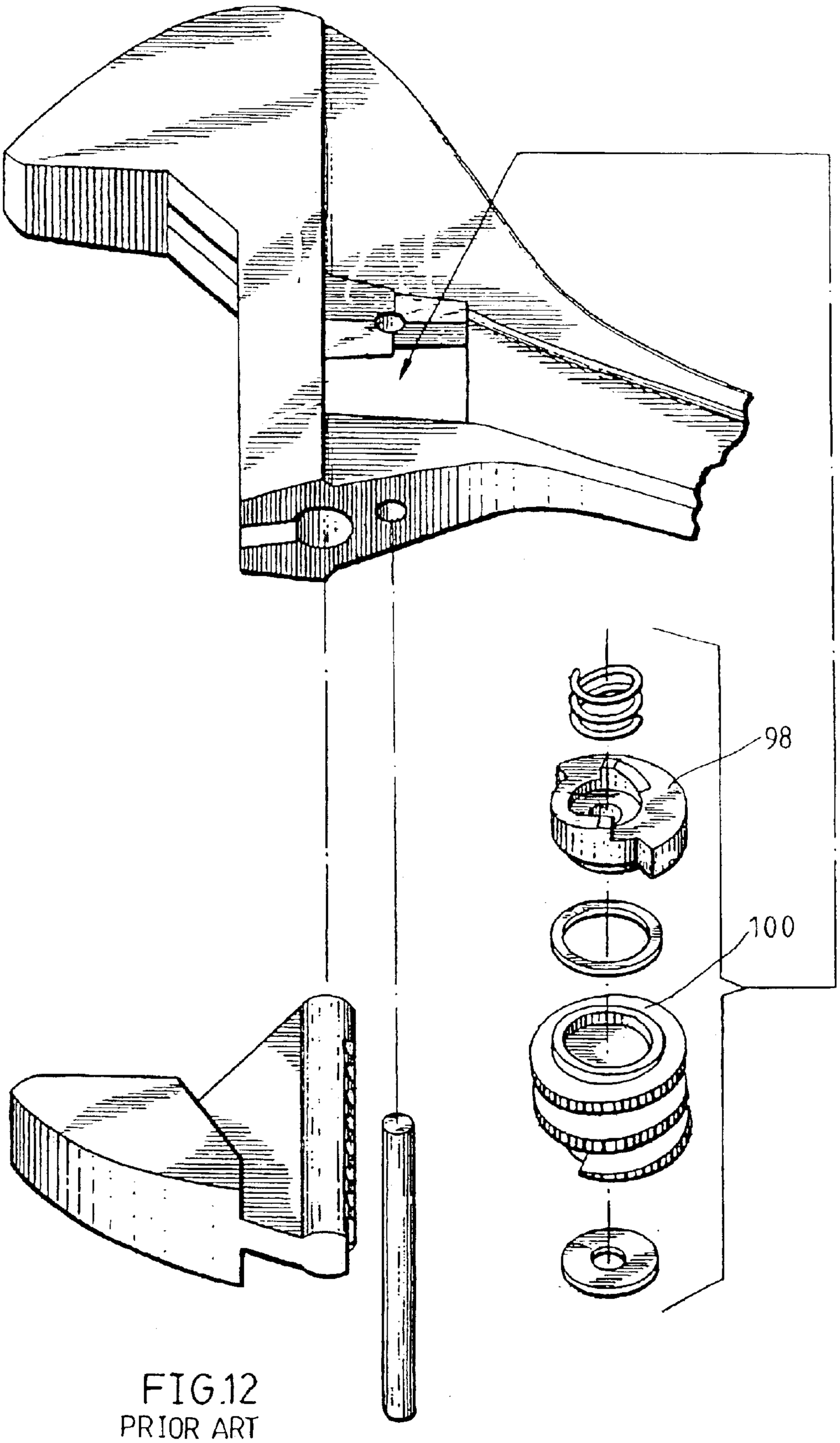

FIG.12
PRIOR ART

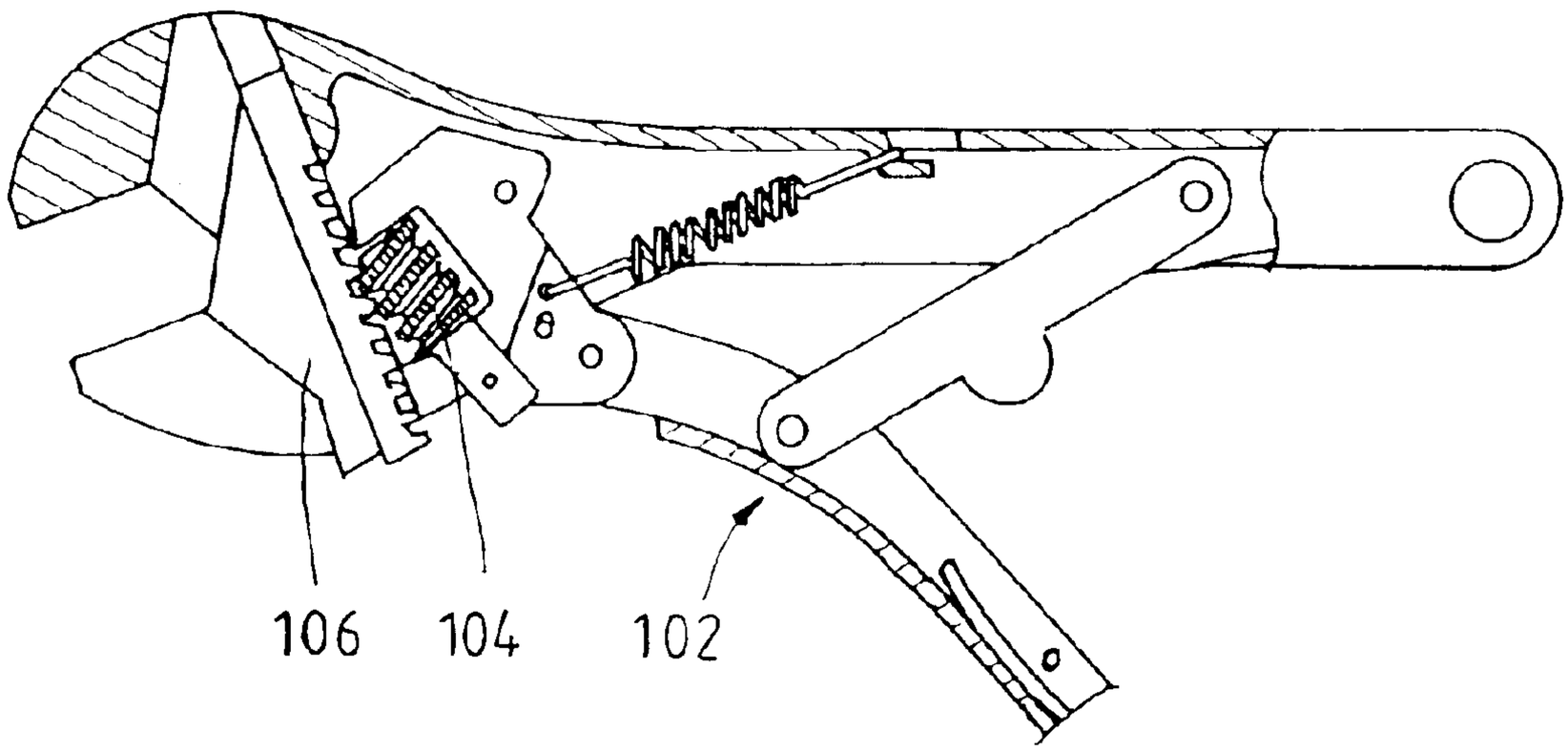

FIG.13
PRIOR ART

SECURING APPARATUS OF ADJUSTABLE WRENCH TO PREVENT MOVABLE JAW FROM TREMBLING

BACKGROUND OF THE INVENTION

1. Field of the Invention.

The present invention relates generally to a hand tool, and more particularly to an adjustable wrench, which can hold a movable jaw when it is moved to a predetermined position.

2. Description of the Related Art

A conventional adjustable wrench comprised a handle having a fixed jaw at an end thereof, a movable jaw slidably provided on the handle having a rack and an adjusting worm pivoted on the handle and engaged with the rack of the movable jaw such that the movable jaw can be moved by turning the adjusting worm.

There must be a clearance of teeth left between the rack of the movable jaw and a helical tooth of the adjusting worm so that the adjusting worm can smoothly drive the movable jaw. But the movable jaw can not stand in a fixed position because of the clearance of teeth since the distance between the movable jaw and the fixed jaw can not be kept constant even though the adjusting worm has not been turned.

FIG. **8** shows a conventional apparatus for an adjustable wrench to secure a movable jaw **78**. The adjustable wrench has a hole **74** on a handle **72** and a fastening device **76** provided in the hole **74**. The fastening device **76** can be screwed into the hole **74** and press the movable jaw **78** to secure the movable jaw.

FIG. **9** shows a second conventional adjustable wrench having a screw bar **82** driven by a nut **80** to press a movable jaw **84**.

FIG. **10** shows a third conventional adjustable wrench having a rectangular slide **86** sliding transversely and against a worm **88** to make the worm **88** can not be turned.

FIG. **11** shows a fourth conventional adjustable wrench having a movable plate **90** with teeth **90** thereon engaged with clutch teeth **96** at a movable jaw **94**.

FIG. **12** shows a fifth conventional adjustable wrench having a locking disk **98** to secure an adjusting worm **100**.

FIG. **13** shows a sixth conventional adjustable wrench having a control mechanism **102** that moves a worm **104** against a movable jaw **106**.

SUMMARY OF THE INVENTION

The primary objective of the present invention is to provide an adjustable wrench, which has an apparatus to secure the movable jaw to prevent the movable jaw from trembling when it has moved to any position.

According to the objective of the present invention, an adjustable wrench comprises a handle having a head portion and shank, wherein the head portion has a fixed jaw, a transverse guiding slot and an opening communicated with the guiding slot, a movable jaw having a guiding portion and a rack on the guiding portion, wherein the movable jaw receives the guiding portion in the guiding slot of the handle to be moved toward or away from the fixed jaw, an adjusting worm having a through hole at a center thereof and a helical tooth an outer surface thereof, wherein the adjusting worm is received in the opening and engages the helical tooth with the rack of the movable jaw whereby the adjusting worm is turned to drive the movable jaw to move along the guiding slot, and an adjusting device having at least a part thereof

received in the through hole of the adjusting worm whereby the adjusting worm is turned freely relative to the adjusting device. The adjusting device is pivoted on the handle to be turned along a rotation axle and the adjusting worm is turned along a rotation axle and the rotation axle of the adjusting device deviates from the rotation axle of the adjusting worm whereby the adjusting device is turned to move the adjusting worm toward or away from the movable jaw.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded view of a preferred embodiment of the present invention;

FIG. **2** is a perspective view of the adjusting device of the preferred embodiment of the present invention;

FIG. **3** is a front view of FIG. **2**;

FIG. **4** is a sectional view in part of the preferred embodiment of the present invention, showing the clearance of teeth between the adjusting worm and the rack of the movable jaw kept in normal;

FIG. **5** is a lateral view of FIG. **4**;

FIG. **6** is a sectional view in part of the preferred embodiment of the present invention, showing the adjusting device being turned so as to move the adjusting worm upwardly to eliminate the clearance of teeth between the adjusting worm and the rack of the movable jaw, and

FIG. **7** is a lateral view of FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

Please refer to FIGS: from FIG. **1** to FIG. **4**, an adjustable wrench of the preferred embodiment of the present invention mainly comprises a handle **10** having a fixed jaw **20** at an end thereof, a movable jaw **30**, an adjusting jaw **40**, and an adjusting device **50**.

The handle **10** has a head portion **11** and a shank **12**. The fixed jaw **20** is located at a distal end of the head portion **11**. The head **11** is provided with a transverse guiding slot **13** and an opening **14** under the guiding slot **13** and communicated with it. The shank **12** has a gap **15** communicated with the opening **14**. The head portion **11** further has a slot **141** on a sidewall of the opening **14** in which a spring **151** and a ball **152** are installed in sequence.

The movable jaw **30** has a guiding portion **31** at an end thereof to be received in the guiding slot **13** of the handle **10** such that the movable jaw **30** can move along the guiding slot **13**.

The adjusting worm **40** has a through hole **41** at a center and a helical tooth **42** at an outer surface, wherein a central axial line of the through hole is as same as a central axial line of the adjusting worm **41**.

The adjusting device **50** includes two round columns. The adjusting device **50** includes an axle portion **51** and a wheel portion **52**, wherein a diameter of the axle portion **51** is slightly smaller than a diameter of the through hole **41** of the adjusting worm **40**. The wheel portion **52** consists of a larger arch portion **521** and a smaller arch portion **522**, wherein a semi-diameter of the larger arch portion **521** is equal to or slightly larger than a semi-diameter of the adjusting worm **40** and a semi-diameter of the smaller arch portion **522** is equal to or slightly smaller than a root semi-diameter of the adjusting worm **40**. The larger arch portion **521** has textures **53** at an annular surface thereof and plural of recesses **54** at an end surface thereof. The recesses **54** are arranged as a semi-circle and the central recess **54**a has a larger diameter

than the rest. The adjusting device **50** has a through hole **55** running the axle portion **51** and the wheel portion **52**. A central axial line of the through hole **55** is deviated from a central axial line of the adjusting device **50** in a predetermined distance.

The axle portion **51** of the adjusting device **50** is inserted into the through hole **41** of the adjusting worm **40** for the wheel portion **52** positioned beside an end of the adjusting worm **40**. The adjusting worm **40** and the adjusting device **50** are installed in the opening **14** of the handle **10** with a spring **17** against a sidewall of the opening **14** and the adjusting worm **40** and a shaft **16** runs through the through hole **55** of the adjusting device **50** and the spring **17** to pivot the adjusting worm **40** and the adjusting device **50** on the handle **10** for free rotation. The helical tooth **42** of the adjusting worm **40** is engaged with rack **32** of the movable jaw **30**. The adjusting worm **40** is turned relative to the axle portion **51** of the adjusting device **50** and the adjusting device **50** is turned relative to the shaft **16**, in other words, the adjusting worm **40** has a rotation axle Lw and the adjusting device has a rotation axle La, the rotation axles Lw and La are two parallel lines and deviated in a predetermined distance.

The adjusting worm **40** is turned along the rotation axle Lw to drive the movable jaw due to the engagement of the rack **32** and the helical tooth **42**.

The adjusting device **50** is turned while user exerts his/her finger on the wheel portion **52**. Under such condition, the adjusting device **50** is turned along the rotation axle La. Because the shaft **16** is not located at the central axle line of the adjusting device **50** so that the adjusting device serves as a cam to the adjusting worm, in other words, the adjusting worm **40** is moved along a diameter orientation while the adjusting device **50** is turned.

In use, I recommend that the adjusting device **50** is turned to a position at where the ball **152** drops into the larger recess **54**a as shown in FIG. **4** and FIG. **5**. The clearance between the rack **32** of the movable jaw **30** and the helical tooth **42** of the adjusting worm **40** is kept in normal in such condition so that adjusting worm **40** is turned freely to move the movable jaw **30**.

While the movable jaw **30** is moved to a suitable position, the adjusting device **50** is turned to move the adjusting worm **40** toward the movable jaw **30** as shown in FIG. **6** and FIG. **7**. The clearance between the rack **32** of the movable jaw **30** and the helical tooth **42** of the adjusting worm **40** will be eliminated, until the adjusting device **50** cannot be turned anymore. The movable jaw **30** is pushed and secured by the adjusting worm **40** while the adjusting device **50** forces the adjusting worm **40** to move towards the movable jaw **30**, and the movable jaw **30** can not move any further in order to keep a distance between the fixed jaw **20** and the movable jaw **30** constant, so that the adjustable wrench will work like an open-end wrench.

The adjusting device **50** is turned reversely to release the adjusting worm **40** from the movable jaw **30** while the movable jaw **30** needs to move again. I suggest that the adjusting device **50** is turned to the position at where the ball **152** drops into the larger recess **54***a*, there will be a suitable clearance between the rack **32** of the movable jaw **30** and the helical tooth **42** of the adjusting worm **40** for adjusting worm **40** driving the movable jaw **30** to move.

Typically, there only is a distance of about 0.5 mm to 1.8 mm for the adjusting worm **40** moving toward the movable jaw **30**. The distance relates to the size of the wrench. The angle of the adjusting device **50** being turned to move the adjusting worm **40** toward the movable jaw **30** relates to a distance between the rotation axles Lw and La.

While the ball **152** drops into the larger recess **54***a*, there is a feedback for user to identify that the adjusting worm **40** has returned the normal position. The ball **152** will drop into one of the recess **54** while the adjusting device **50** is turned to a predetermined angle. There will be a positioning force for the adjusting device **50** to prevent it from being turned by accident.

The largest distance of the adjusting worm **40** moved by the adjusting device **50**, in practice, is larger than the clearance between the rack **32** of the moveable jaw **30** and he helical tooth **42** of the adjusting worm **40**. The adjusting device **50** only needs to be turned a given angle, the adjusting worm **40** can be move for a sufficient distance to eliminate the clearance. User will get a feedback that he/she cannot turn the adjusting device **50** anymore when the clearance has been eliminated.

What is claimed is:

1. An adjustable wrench, comprising:

a handle having a head portion and shank, wherein the head portion has a fixed jaw, a transverse guiding slot and an opening communicated with the guiding slot;

a movable jaw having a guiding portion and a rack on the guiding portion, wherein the movable jaw receives the guiding portion in the guiding slot of the handle to be moved toward or away from the fixed jaw;

an adjusting worm having a through hole at a center thereof and a helical tooth at an outer surface thereof, wherein the adjusting worm is received in the opening and engages the helical tooth with the rack of the movable jaw whereby the adjusting worm is turned to drive the movable jaw to move along the guiding slot;

an adjusting device having at least a part thereof received in the through hole of the adjusting worm whereby the adjusting worm is turned freely relative to the adjusting device; and

wherein the adjusting device is pivoted on the handle to be turned along a rotation axle and the adjusting worm is turned along a rotation axle and the rotation axle of the adjusting device deviates from the rotation axle of the adjusting worm whereby the adjusting device is turned to move the adjusting worm toward or away from the movable jaw.

2. The adjustable wrench as defined in claim **1**, wherein the adjusting device has a through hole deviated from a center of the adjusting device and a shaft runs through the through hole to pivot the adjusting device on the handle.

3. The adjustable wrench as defined in claim **1**, wherein the adjusting device has an axle portion and a wheel portion wherein the axle portion is inserted into the through hole of the adjusting worm and the wheel portion is positioned beside an end of the adjusting worm.

4. The adjusting wrench as defined in claim **3**, the wheel portion of the adjusting device has textures at an annular surface thereof.

5. The adjustable wrench as defined in claim **3**, wherein the wheel portion of the adjusting device has a larger arch portion and a smaller arch portion wherein a semi-diameter of the larger arch portion is about equal to or slightly larger than a semi-diameter of the adjusting worm and a semi-diameter of the smaller arch portion is about equal to or slightly smaller than a root semi-diameter of the adjusting worm.

6. The adjustable wrench as defined in claim **5**, wherein the wheel portion of the adjusting device has textures at an annular surface of the larger arch portion.

7. The adjustable wrench as defined in claim **1**, wherein the adjusting device has a plurality of recesses at an end thereof.

8. The adjustable wrench as defined in claim **7**, wherein the handle is provided with a slot at a sidewall of the opening in which a spring and a ball are installed in sequence

wherein the ball drops into the recesses respectively while the adjusting device is turned.

9. The adjustable wrench as defined in claim **7** wherein one of the recesses is larger than the rest.

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